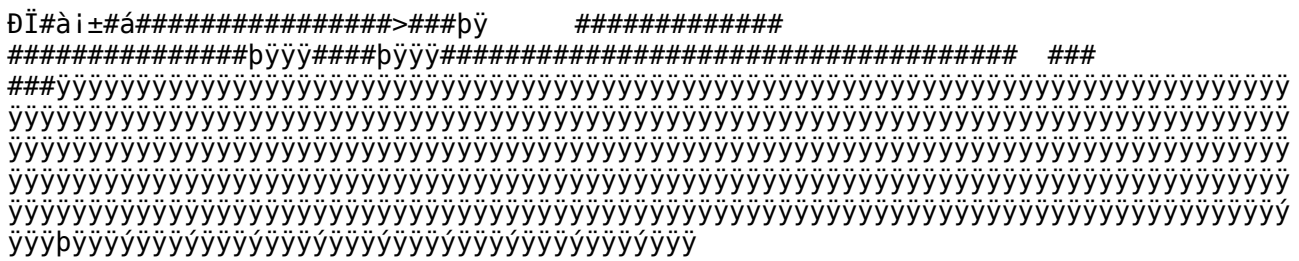

```
#################,########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########□###Past Practices - Use of
Chemically Based Paint StrippersAlternative Paint Stripping Techniques
DescriptionAdvantagesDisadvantagesExamples of Use
```

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########è###DoD paint removal processes using chemically based paint strippersLarge volumes of chemicals to strip paint Large quantities of hazardous wastesHigh levels of VOCs emittedWorker safety jeopardizedControl equipment often required

```
#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########□###Hazardous materials of concern
Methylene ChloridePhenolFormic AcidSodium ChromateSulfuric AcidMethyl Ethyl
Ketone (MEK)Methyl Isobutyl Ketone (MIBK)
```

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########À###DoD HAZMIN Program Goals
Reductions in use of EPA-17 ChemicalsHazardous Waste DisposalAir EmissionsHigh quantities of VOCs generatedHealth EffectsRegulatory TrendsBecoming more stringent

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########□###Tinker AFB, OKUsed benzyl alcohol and methylene chlorideUsed for paint removal on primary structures to lessen the risk of material thinning or stressing#

```
#################,########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########□###Charleston AFB, SCUse
chemicals for small partsMethylene ChloridePhenolsMEKPurchased a recycling unit
to allow reuse of MEK
```

```
#################,#########################@ÿ#ÿÿd#########d#########2####ªöüV
      s#ÿÿ####ÿÿ####Qÿ#ÿÿd#########d#########=###Offutt AFB, NEUsed MEK to
small degree for removing neoprene#
```

#################,########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########Õ###Benefits DesiredReduced Employee Exposure to Hazardous ChemicalsReduced Air EmissionsReduced Hazardous Waste GenerationReduced Disposal CostsMinimize Environmental RisksMinimize Cost of Potential Liabilitiesÿ

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########º###Charleston AFB, SCNeeded to use MEKPurchased recycling unitOver 95 percent of amount initially applied recycled for reuseClosed Loop Mechanical Paint StrippingRecycle blasting media

```
#################,########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########í###Utilize Alternative Organic
StrippersReplace with potentially less harmful organic solventsMany still being
testedHealth effects unknownEffectiveness questionedLow Emission Methylene
Chloride Based StripperLimited situations of useÿ
```

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      ö#ÿÿ####ÿÿ####@ÿ□#ÿÿd#########d#########□###
Integrated Solvent Substitution Data System (ISSDS) Solvent Alternatives Guide (SAGE) Hazardous Solvent Substitution Data System (HSSDS) Tri-Services Pollution Prevention (P2) Library Department of Defense Ozone Depleting Chemical/Substance Information Solvent Handbook Database System (SHDS) Solvents Database (SOLV-DB) Materials Compatibility Database (MATCOMPAT) Related Documents

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      s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########□###Greatest Opportunities In This
AreaDry Media BlastLiquid Media BlastPulse MediaInfra-redEnzymatic Biostripping
Other MethodsE
```

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#############Plastic Media Blasting (PMB)
Bombardment with soft plastic granulesPerformed in small to large spacesProcess
DescriptionBlasted at less than 40 psiMinimal effect on substrate surface
Recycled 10-12 timesSeveral types, sizes, hardnessesCurrently in use in Nave,
Army, and Air Force

```
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      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########Ë###Plastic Media Blasting (PMB)
cont.AdvantagesWell Developed TechnologyUses Conventional Blasting Equipment
Liquid HW Virtually EliminatedSafe to WorkersMedia Can Be RecycledWaste Solvents
Eliminated#
```

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########©###Plastic Media Blasting (PMB) cont.DisadvantagesSubstantial Capital InvestmentLarge Solid Waste Stream GeneratedMay Cause Metal FatigueMay Not Remove Heavy Corrosion#

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########å###Kelly AFB, TXPMB to remove paint from aircraft and componentsCharleston AFB, SCPMB for all parts except small partsMcClellan AFB, CAPaint Stripping from Aircraft SkinRecycle 90% of PMB 3,000 lbs SW compared to 10,000 lbs SWo

```
#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#############CO2 BlastingBombardment with
carbon dioxide pelletsTwo typesPellet Blasting - Heavy CleaningSnow Blasting -
Precision CleaningProcess DescriptionCO2 stored under pressureLiquid CO2 fed to
pelletizerPellets applied to surfaceSurface coating weakens
```

```
#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########Ù###CO2 Blasting cont.Advantages
Only paint chips require disposalEffective against most coatingsLeaves no
residue on surfaceEffective in precision cleaningAlso effective for parts
cleaning - not just paint strippingn
```

```
#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########Á###CO2 Blasting cont.
DisadvantagesPotentially high capital costsPotential surface damage to sensitive
substratesOperator needs contained air supplyNonautomated system fatigues
workers quicklyM
```

#################,########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########□###Liquid Nitrogen Stripping
Liquid nitrogen causes surface coating to become brittleBombarded with plastic shot to remove embrittled paint

#################,########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########Ô###Liquid Nitrogen Stripping cont.AdvantagesSmall units commercially availableNo liquid hazardous waste DisadvantagesNot applicable to large scale operationsNot effective on all coatingsStill under development

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########(###Wheat Starch BlastingSimilar to PMBWheat Starch is softer mediumEffective on aluminum alloys, graphite, and fiberglassEffective on all types of coatingsresistant coatings on radomestough polyurethane and epoxy paintspaint from cadmium plated partsStored in moisture controlled environment

#################,#########################@ÿ#ÿÿd#########d#########2#####ªöüV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########¾###Wheat Starch Blasting cont.
AdvantagesPlentiful resource that is biodegradableMedium can be recycled 15-20 timesEffective against wide variety of coatingsVery little damage to substrates

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########Þ###Wheat Starch Blasting cont. DisadvantagesHigh capital investmentRecycle of media complexPotential storage problems in moist environmentsConcerns with spontaneous combustion / explosion potentialStill under development

```
#################,########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########þ###Fluidized Bed StrippingHeats
part > 650FPyrolysis and decomposition of organic portion of coatingProcess
DescriptionPart placed in fluidized bedHeats to pyrolysis temperatureCooledCO
and VOCs burned in afterburnerChar removed with shot blast unit
```

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      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########□###Fluidized Bed Stripping cont.
AdvantagesLeaves practically no waste residueCleans parts of any geometry/size
and any coatingCleans to bare metals
```

```
#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########ª###Fluidized Bed Stripping cont.
DisadvantagesNot suitable for heat sensitive materialsBed media may be regulated
as HWSecondary cleaning requiredStill under development
```

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#############Sodium Bicarbonate Blasting
Soda / Water mixture impacts surfaceWater dissipated heat generatedWater reduces dust generatedWater assists in paint removalCan be used dry alsoPrimary concern
At T > 140-160F, Sodium Bicarbonate may convert to Sodium Carbonate which is corrosive

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########´###Sodium Bicarbonate Blasting cont.AdvantagesCan selectively remove individual coating layersLittle damage to substrateMedia inexpensiveDedicated facility not requiredEffective

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########¼###Sodium Bicarbonate Blasting cont.DisadvantagesRequires subsequent washingElectrical components cannot be exposedSubstantial wastewater generatedCorrosion concernsMedia not recyclable

```
#################,########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########J###Sodium Bicarbonate Blasting
cont.NavyDepainting and cleaning bilge areas
```

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########Ý###Water Jet BlastingStripping media is pressurized waterMedium Operations = 3,000 - 15,000 psiHigh Operations = 15,000 - 55,000 psiMay be augmented with Sodium Bicarbonate or IceWater can be recycled for subsequent use#

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########í###Water Jet Blasting cont. AdvantagesSafe in confined environmentVery little damage to substratesCan selectively remove individual layersNo dust or airborne contaminants generatedNo precleaning requiredDedicated facility not required×

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Water Jet Blasting cont.

DisadvantagesPotentially high capital costsApplication to high performance exterior coatings in questionWastewater disposal requirements vary on toxicity of coating being removedWater can penetrate/damage joints, seals, and bonded areasHigh pressure jet can be a physical hazard

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########□###Water Jet Blasting cont.Tinker AFB, OKDeveloping robots for water jet applicationKelly AFB, TXHigh pressure water to remove foam from fuel cells

#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#############Xenon Flashlamp Stripping
Process DescriptionPulsing an electric current to a xenon gas-filled quartz lamp
Light concentrated and projected to surfaceLight intensity breaks chemical bonds
holding coating to surfaceBy-products captured at point of inception+

```
#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########□###Xenon Flashlamp Stripping
cont.AdvantagesVery little waste generatedWaste captured at point of inception
Not harmful to electronics
```

```
#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########±###Xenon Flashlamp Stripping
cont.DisadvantagesRequires extensive operator trainingQuestion with respect to
surface damage and worker safetyNot effective on light-colored coats#
```

```
#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########□###Xenon Flashlamp Stripping
cont.F-15s at Warner Robins ALCFlashlamp system softens paintDry ice pellets
remove the softened paint#
```

#################,########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########â###Laser Paint StrippingPulsed laser evaporates coatingAdvantagesLittle waste generationEasier control than flashlampDisadvantagesExpensiveQuestions concerning surface damage and worker safetyPotential harm to electronics

```
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      ###@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####Qÿ□#ÿÿd#########d#########¯###Infra-Red Stripping
Concentrated infra-red light heats coating to point of combustionTemperature of
substrate not significantly affectedVacuumed into HEPA containment system#
```

```
#     #########   #####,########### #########
      ###@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########□###Infra-Red Stripping cont.
```

AdvantagesCan be applied to remove coatings on or around delicate equipment

DisadvantagesEarly stages of development

```
#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########Ú###Enzymatic Biostrippping
```

Microbial enzyme responsible for degrading paintAdvantagesDegradation of paint chip wastesReduction of wastes generatedSafe work environmentLess damaging to substratePotentially economical

```
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      ##ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########Ò###Process ChangesAir ForcePMB to
replace chemical strippingArmyFluidized bed paint strippingExtension of
stripping solutionsNavyCryogenic (liquid nitrogen) strippingPulsed laser
strippingUV based systems
```

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#################,#########################@ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ####ÿÿ####UÿF#ÿÿA#########d#########□###Material SubstitutionAir Force
Biodegradable paint strippersArmyAlternate chemical paint stripper formulations
NavySinkable / biodegradable plastic#
```

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###@ÿ□#ÿÿd#########d#########2##□##ªö□üV s#ÿÿ
###ÿÿ####Uÿn#ÿÿK#########d#########£###Past practices being phased outTrend
toward process modificationsNumerous applications still under development and /
or refinementTradeoffs to every alternative@
```